

**What is claimed is:**

1. A method for fabricating a film bulk acoustic resonator(FBAR) device having air gap, comprising steps of:
  - forming a sacrificial layer on a substrate;
  - forming a photoresist pattern on a portion of an upper surface of the sacrificial layer;
  - forming a sacrificial pattern by etching the sacrificial layer by using the photoresist pattern as an etching mask;
  - depositing an insulating material on the substrate;
  - forming a membrane supporting layer on sides of the sacrificial pattern by eliminating the insulating material and the photoresist pattern on the sacrificial pattern so that the sacrificial pattern and the insulating material have the same height;
  - forming a membrane layer on the sacrificial pattern and the membrane supporting layer;
  - forming a first electrode on the membrane layer;
  - forming a piezoelectric layer on the first electrode;
  - forming a second electrode on the piezoelectric layer; and
  - removing the sacrificial pattern to form the air gap.
2. The method according to claim 1, wherein said step of forming a sacrificial pattern includes the step of over-etching the sacrificial layer so that sides of the sacrificial pattern have an undercut structure.

3. The method according to claim 2, wherein the step of over-etching the sacrificial layer further comprise the step of controlling the width of the undercut structure after the step of over-etching the sacrificial layer.

4. The method according to claim 3, wherein the step of controlling the width of the undercut structure is performed by using reactive ion etching(RIE) process.

5. The method according to claim 3, further comprising the step of controlling edge profile of the photoresist pattern by using hard-baking process for 1-10 min, at 130-200°C on a hot plate, after the step of forming a photoresist pattern.

6. The method according to claim 2, wherein the width of the undercut is approximately 0.2-3  $\mu\text{m}$ .

7. The method according to claim 1, wherein the thickness of the sacrificial pattern is approximately 0.5-5  $\mu\text{m}$ .

8. The method according to claim 1, the step of removing the sacrificial pattern to forming air gap includes the steps of:

forming at least one via hole to expose the sacrificial pattern out of FBAR device; and

wet-etching the sacrificial pattern through said at least one via hole.

9. The method according to claim 8, the step of wet-etching the sacrificial layer includes the step of wet-etching the sacrificial pattern with  $\text{HNO}_3$  as an etchant.

10. The method according to claim 8, wherein said at least one via hole is formed in at least one corner of the sacrificial pattern.

11. A method according to claim 1, the sacrificial layer comprises a material selected from the group consisting of Al, Cu, NiFe and ZnO.

12. A method according to claim 1, the insulating material includes a material selected from the group consisting of  $\text{SiO}_2$ , SiN and  $\text{Al}_2\text{O}_3$ .

13. A method according to claim 1, the piezoelectric layer includes AlN or ZnO.

14. A film bulk acoustic resonator(FBAR) device, comprising:  
a substrate having a first area and a second area surrounding the first area;  
a membrane supporting layer formed on the second area of the substrate so as to form an air gap on the first area of the substrate;  
a membrane layer on the membrane supporting layer and the air gap;  
a first electrode on a portion of the membrane layer;  
a piezoelectric layer on a portion of the first electrode; and

a second layer on a portion of the first electrode